

# QUARTERLY REVIEW

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Geologic Investigation in the State of Utah

May 1970

## MHD OFFERS SOLUTION

A power production technique capable of overcoming some of the difficulties associated with techniques now in use is being aired.

The development of magnetohydrodynamics, or MHD, as part of an overall coal research program, was discussed in a public hearing on Emerging Power Techniques held in December by Sen. Frank Moss (D-Utah), chairman of the Senate Subcommittee for Minerals, Materials and Fuels of the Committee on Interior and Insular Affairs.

In a statement before the subcommittee by Arthur A. Kantrowitz, director of Avco Everett Research Laboratory and vice president of Avco Corporation, the five principal advantages of MHD over coal-fired or nuclear power plants were outlined:

1. Drastically reduce thermal and atmospheric pollution.
2. Better use our coal reserves and other natural resources, especially low-grade coal.
3. Open opportunities for the development of water-scarce areas.
4. Improve the efficiency and reliability of our electric power systems.
5. Provide low cost power.

Kantrowitz summarized the power systems in his testimony.

Conventional steam-electric power generation produces electric energy in three steps:

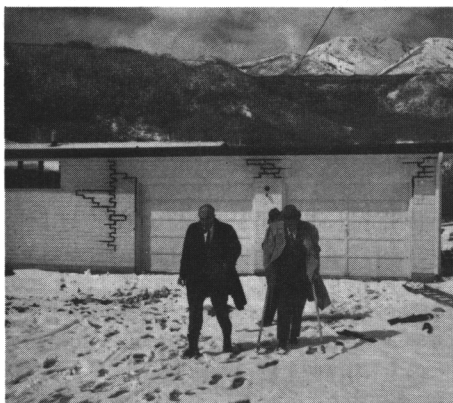
1. Fuel and air are burned together in a furnace.
2. The resulting heat makes steam in a boiler; the steam is expanded in a turbine to produce mechanical power.
3. The turbine shaft drives the elec-

(Continued on page 3)

## Field Day for Real Estate Examiners

The Utah State Board of Real Estate Examiners were conducted on a field excursion to examine results of poor planning and geologic ignorance. Bruce Kaliser, UGMS engineering geologist, oriented the Board in the State Division of Real Estate offices and then accompanied them to inspect a particularly afflicted subdivision that he has been monitoring over the past two years. The subdivision is composed of homes worth upwards of \$25,000 each and is experiencing severe problems with expansive clay, reactivated landsliding, ground frost and impermeable septic tank filter field soils.

Snow covering on the ground offered protection from the highly plastic clay that normally quickly overtops one's boots and weighs one down with the ever-accumulating clods. Despite the weather the group was able to see clearly the magnitude of the problems.



Examination of house heavily distressed by renewed landslide activity. Not cracks in mortar, and the ancient landslide terrain in background.

UGMS has installed a strain gauge (extensometer) across a hairline tension crack in the landslide. The photograph below shows the tilt of a utility pole situated in the same tension crack. The relief on the ancient landslide in the background of the photograph makes it extremely attractive as an area in which to expand the subdivision. New communities serving as dormitory towns for the Wasatch Front are likely to enlarge considerably.

The Board is to be commended for its forthright approach to this demonstration of the result of lack of planning and UGMS hopes that further cooperation will minimize the Topsy-like growth which proves to be so disastrous.



Left to right: Jesse M. Payne, State Dept. of Contractors; Marion Wallace and Glen Baugh, Board of Real Estate Examiners; Monroe Tucker, Director of the State Division of Real Estate, all standing on the head of the slide. Standing on the crown of the landslide are, left to right, Edwin Stein, Chairman of the Board of Real Estate Examiners, and Ray Hansen, State Dept. of Contractors.

## Uinta Basin, Southern Utah Record Oil Discoveries

### GROUNDWATER DETERIORATING

The chemical quality of the groundwater in large areas in Utah is deteriorating, according to U. S. Geological Survey Professional Paper 650-D. The study, by Hardy, Mower and Sandberg, was issued from the Salt Lake office of USGS in 1969.

Most of the records of rainfall, well level and specific conductance of well water cited in the report go back to 1957, some to 1931. Three areas in south central and southwest Utah were under study: Pavant Valley, Sevier Desert and Escalante Valley.

Changes in the chemical character of the groundwater result mainly from dissolved materials in the irrigation water which recharges the aquifers. Crop-plant debris and fertilizers dissolved in substantial amounts increase chemical concentrations. In fact, water entering the Sevier Desert in the Sevier River has been reused several times in upstream irrigation operations. Each time a part of the diverted water returns to the river, with an ever-increasing load of chemicals, both from the irrigation operation and from leaching the soil through which it travels.

Another factor in deteriorating water quality is the decline in water levels in pumping operations. As the well level declines, groundwater of poor quality is drawn into it, causing further deterioration. Water from several wells in the Kanosh district in the Pavant Valley is reported to be unusable for irrigation as a result of recirculation of irrigation water.

The quality of groundwater in these districts will continue to deteriorate, according to the USGS hydrologists, as long as present irrigation practices continue to prevail.

### *Utah Industrial Minerals Map Released by UGMS*

A new map of the industrial minerals of Utah has been recently released by the Utah Geological and Mineralogical Survey. Prepared by Hellmut H. Doelling, economic geologist of the Survey, the map shows where industrial minerals may be found in the state, whether the sites are developed or not and whether actively producing.

In the closing months of 1969, Utah scored two new oil field discoveries, both in Duchesne County and both considered significant indicators of possible new prolific oil production in the sparsely drilled western Uinta Basin.

The largest discovery, Mountain Fuel Supply No. 2 Cedar Rim, SW NE 20-3S-6W, completed flowing 888 barrels of oil per day from an upper Wasatch (Eocene) sandstone at 8580 to 8670 feet. In February Mountain Fuel also established flowing oil production in this well from 7794 to 7828 and 8095 to 8211 in the lower Green River Formation (Eocene). Production from these Green River zones averaged 1142 barrels of oil per day with 1.212 million cubic feet of gas per day. At least three other zones in the Green River Formation indicated possible oil production on tests during the drilling of the well.

The other Duchesne County discovery was Gulf Oil No. 1 Ute Tribal-Cottonwood Wash, SE NW 7-1N-3W, in basal Tertiary sandstones, probably lower Green River, from 9894 to 9904. The discovery, located in the structurally complex area along the south flank of the Uinta Mountains, flowed 195 barrels of oil per day.

Mountain Fuel has stepped out 4½ miles west of its discovery and is drilling a 9000-foot Wasatch test in the Sink Draw area. No plans for extension of the Gulf discovery have been announced.

The Utah Oil and Gas Conservation Commission has officially named the

two discoveries Cedar Rim and Cottonwood Wash fields.

In the first quarter of 1970, interest in the western Uinta Basin heightened as reports from Shell Oil No. 1 Miles, SW NE 35-1S-4W, Duchesne County, suggested a possible oil discovery in Green River and Wasatch sandstones. The Shell well, located 10 miles south of the Gulf discovery and 18 miles northeast of Mountain Fuel's new production, is in the middle of a large untested part of the basin.

Late 1969 and 1970 also saw active development drilling and new production in the Duchesne and Bluebell fields in Duchesne County. Bluebell, where oil production began in late 1967, had produced more than 2,100,000 barrels of oil from 18 wells by the end of March 1970, and production was averaging 3,500 barrels per day. Upon application of Chevron Oil, principal field operator, the Utah Oil and Gas Conservation Commission established 640-acre spacing for oil wells at Bluebell. This is the widest spacing for oil in any Rocky Mountain region field.

In southern Utah early 1970 saw announcement of the second oil field in the Kaiparowits Basin, Garfield County. Tenneco Oil indicated that its No. 1 Johns Valley-Federal SE NW 35-35S-2W was completed as an oil well from Mississippian limestone at 11,029 to 11,040 feet. Production rates were not revealed, and additional possible production from shallower depths are being tested. Johns Valley Field follows Upper Valley where Kaibab (Permian) production began in 1964.

In southeast Utah's Paradox Basin, Buttes Gas and Oil completed No. 1-22 Federal in NE NW 22-37S-23E, San Juan County, as a new field discovery one mile southwest of the one-well Alkali Canyon Field now shut in. Flowing production of 41 barrels of oil per day was removed from Desert Creek (Pennsylvanian) at 6390 to 6408 feet.

Map 29, printed in color, is 11 by 16 inches with descriptive summaries of each locality printed on the back. Copies may be obtained at 103 Utah Geological Survey, Univ. of Utah, Salt Lake City 84112, for 35 ¢, or 50 ¢ prepaid. Mail orders should include the price of the map with the order.



## MHD OFFERS SOLUTION

(Continued from page 1)

tric generator which delivers power to the load.

In the generator, the electric power is produced by motion of a copper wire armature through a magnetic field. In the nuclear plant, the reactor replaces the furnace-boiler; otherwise the plant resembles a conventional coal-fired plant.

Technical and economic factors in this three-step process limit efficiency in the coal-fired unit to about 40 percent, and in the nuclear plants to about 30 percent. All the fuel energy not converted into electric power is delivered to the surroundings in the form of heat, usually into rivers, lakes and cooling towers. The pressure of this heat rejection is already taxing the water-rich areas of the country; in water-poor areas, the heat rejection limits development, particularly in the fuel-rich but water-poor western states.

MHD combines all the steps into one. The hot combustion products of fuel and air are made to conduct electricity by addition of small amounts of a salt. These gases become the "armature" of the generator; they move at high velocity through the magnetic field where electric power is generated directly.

This direct process eliminates the factors limiting the efficiency of the conventional system. Efficiencies of nearly 60 percent will result, and correspondingly less heat need be absorbed by the surroundings. MHD plants can in fact be designed to eliminate all thermal water pollution, according to Kantrowitz.

Sulfur dioxide and oxides of nitrogen, the most objectionable gaseous emissions from thermal power plants, will inevitably increase with increasing demands for electric power, and solutions to the problem advanced thus far have many undesirable side effects. In the MHD plant, combustion occurs in such a way that these noxious gases can be virtually eliminated while delivering useful byproducts for manufacture of fertilizer.

Important national MHD programs are underway in West Germany, the

Soviet Union and Japan.

Joseph P. Brennan, director of the Research and Marketing department, United Mine Workers of America, made it clear in his testimony that allocation of Federal research and development money, with \$200 million per year for atomic energy funding and \$20 million for coal research, displays "a myopia of vision and a misapplication of resources," and that intensive coal research would lead to the most workable solution to our power problems.

Brennan stated there are more than 1 trillion tons of recoverable coal reserves in this country and that most of it is located west of the Mississippi River.

## RESOURCES GOALS FRAMED

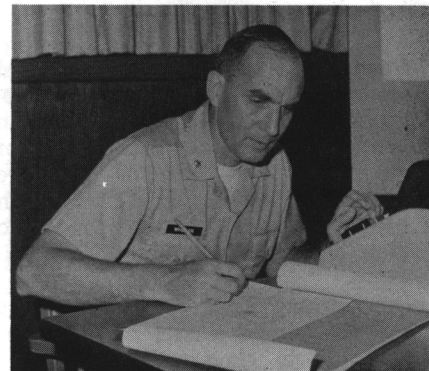
Natural resource goals and implementation are the concern of a committee of the Utah Legislative Council with the impressive title of Citizens' Planning and Organization Committee on Natural Resources.

Meeting weekly, the 12-member group has framed goals relating to recreation, land, water, minerals and air, and are exploring specific ways of attainment. The report which will result is designed to provide future legislators with a framework of recommendations to guide Utah's natural resource management.

The committee is composed of private citizens concerned with natural resources, two members of the legislature and several educators with specialties in natural resource matters. Chairmanship of the group has passed from Fred Montmorency, former mayor of South Ogden, to Merrill Ridd of the Geography Department at the University of Utah. William P. Hewitt, director, and Howard Ritzma, petroleum geologist both of the Utah Geological and Mineralogical Survey, are active members of the committee in mineral-related matters.

## UGMS Staff Member on Leave

Even though J. A. Whelan, UGMS geologist is on leave for a tour of duty in the U. S. Navy on Guam, with the rank of commander, he spends some of his spare time working on research being conducted on the Great Salt Lake. Whelan is Deputy Officer in charge of Construction for the Navy on Guam, and started a two-year tour in July, 1969.



Shortly after he left for Guam, Cdr. Whelan's paper, Special Studies 30 in the UGMS series, *Soluble Salts and Subsurface Brines of Sevier Lake, Utah*, was published, and another, of which he is co-author, *Mineralization in the Gold Hill Mining District, Tooele County, Utah*, appeared recently. The latter paper, Bulletin 83, was originally a PhD dissertation written by M. H. El-Shatoury. Whelan supervised his research and assisted in preparation of the manuscript for publication.

A third paper, in press, *Radioactive and Isotopic Age determinations of Utah Rocks*, is a compilation of the results of work done by Whelan and other workers on isotopic age dating.

In March, Whelan presented a paper on his research activities to a joint meeting on Guam of the Society of American Military Engineers and Guam Professional Engineers Society.

When the research in Whelan's charge is completed, the study will provide definite information on the effect of the railroad causeway on brine concentrations and on the potential of the lake as a commercial mineral source. The lake has long been a source of common salt, but there is greater value in lithium, magnesium, potassium salts and sodium sulfate. Estimates indicate there are about \$20 billion worth of recoverable chemicals in Great Salt Lake.

## Geologic Hazard Study Prevents Goof

by Bruce N. Kaliser  
UGMS Engineering Geologist

Geologic investigation of a major potential geologic hazard has undoubtedly prevented one big engineering headache, according to Bruce Kaliser, UGMS engineering geologist.

In the landslide-prone benchland bordering Utah's megalopolis (Provo-Salt Lake City-Ogden-Brigham City), an ancient landslide covers an area of approximately one fifth of a square mile and encompasses a site on which in 1969 the property holder planned to develop an apartment house complex.

Downcutting by the major drainage course has caused sliding of the interbedded deltaic clays, silts and sands since Pleistocene time. Conditions are aggravated by surface and subsurface drainage. The active Wasatch fault zone exists no more than half a mile to the east.

The real estate and development company holding this property engaged the services of an engineering geologist and a soils engineer.

Geologic reconnaissance showed that history, indeed prehistory, has repeated itself. The road and the irrigation canal across the end of the foot of the slide have been affected on more than one occasion. Groundwater in deeper interbedded sands is under artesian pressure. Test borings in and above the site show the entire site to be underlain with distorted and sheared sediments. The sediments were originally laid down on nearly horizontal planes in ancestral Lake Bonneville. Extensive deformation as revealed in undisturbed samples taken in the test borings and bulldozer cuts clearly demonstrate ancient, relatively deep-seated land-sliding.

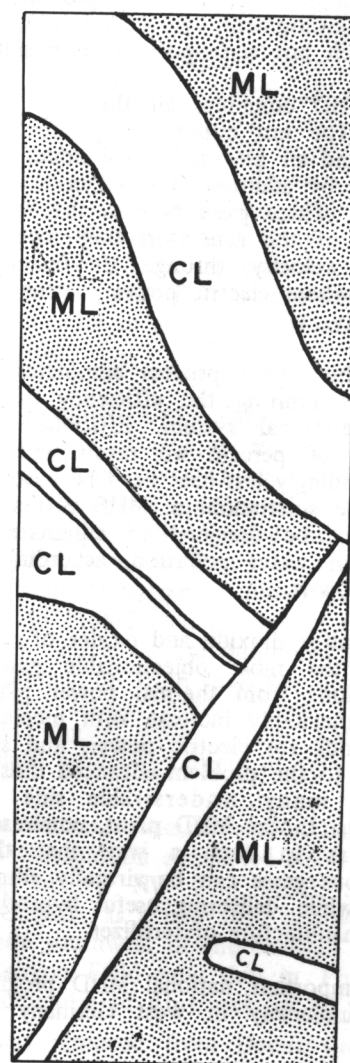
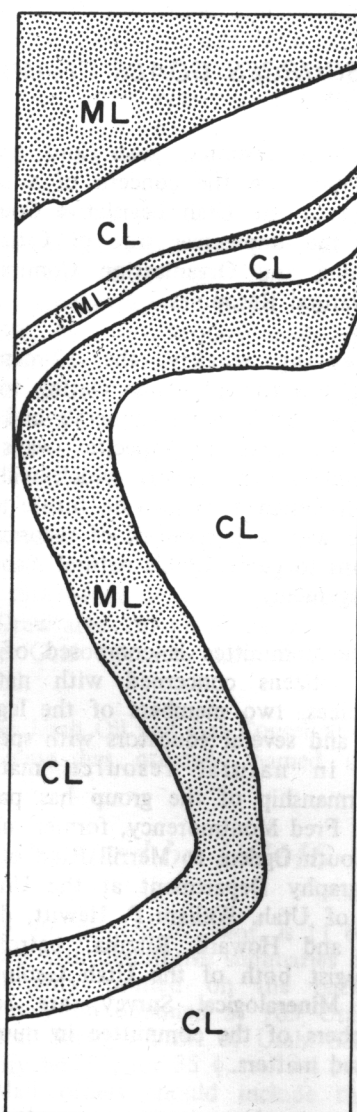
The amenities offered by this prop-

erty include its proximity to a large city and to a military reservation, its natural serenity and the attractive views of the Great Salt Lake Valley. A clubhouse already occupies a site at its lower end. A municipal golf course lies across the road on the valley flood plain.

The real estate and development company holding this property apparently is the first in Utah to use the engineering and geological information and personnel available in the state. With a knowledge of the conditions on

the site at hand, the company then understood the magnitude of the problems. Stabilization would be the first requirement on this site, and development of the site revolves around the means of accomplishing this. In this instance the economics of ensuring against further earth movement led to a decision by the company to eliminate consideration of the site for multistory dwellings.

Responsible planning that takes into full account the geologic aspects of a site is one of the goals of UGMS. Much effort and expense may be avoided by incorporating specific geologic information into the early stages of planning and development. UGMS stands ready, willing and able to do its part in assisting developers to avoid costly errors.



At right, vertical sections of split spoon samples that have been pressed on paper show deformations from depths of 20.5 and 50.5 feet below the surface of the landslide. ML = low plasticity silt; CL = low plasticity clay (Unified Soil Classification). Drawings are actual size.

## BEAR LAKE VALUE CITED

"Environmental Geology of the Bear Lake Area, Utah, with Application to Planning in the Intermountain West" was the title of a paper presented at the AIME annual meeting by UGMS UGMS engineering geologist Bruce Kaliser. The meeting was held in Denver on February 16, 1970. Theme of the geological engineering session of the meeting was geology and the environment.

Kaliser, newly appointed membership chairman of the geological engineering unit committee of A. I. M. E., discussed the Bear Lake area in terms of its geological setting and potential development. The lake, lying half in Utah and half in Idaho, has a high recreation value, but the active Bear Lake Fault and the saturated unconsolidated sediments bordering the lake make earthquake damage a possibility to be taken into account in construction and development of land surrounding the lake. Ample groundwater of good quality is available.

According to Kaliser, the Rich County Commission, in whose jurisdiction the Utah half of Bear Lake lies, should anticipate increased urbanization in this area, and by creating zoning controls early, regulate the growth already starting. Also, Kaliser added, cooperation with Idaho agencies would enhance the recreational value of the lake for both states.

## U. S. BUREAU OF MINES OFFICE MOVES

Utah's congressional delegation jointly introduced legislation in the Congress which would permit the U. S. Department of Interior to move its Bureau of Mines offices at 1600 East First South, Salt Lake City, on the University of Utah campus, to the new University Research Park. Reason: "The university property is desperately needed for other purposes," according to university officials.

## EARTHQUAKE EPICENTERS

General earthquake epicenters in or near Utah in September, October and November 1969, with dates of occurrence and approximate magnitude, are listed below:

DECEMBER	Magnitude
2 Near Salt Lake City . . . . .	<1.5
2 San Rafael Swell . . . . .	1.8
2 Southwest Wyoming, about 110 miles east of Logan . . . . .	2.5
2 South of Sunnyside . . . . .	2.0
4 Southwest Wyoming, about	
4 Near Kamas . . . . .	2.9
9 South of Sunnyside . . . . .	3.0
9 Near Cedar City . . . . .	3.0
10 South of Sunnyside . . . . .	3.5
11 San Rafael Swell . . . . .	2.5
11 Southeast Idaho, north of Bear Lake . . . . .	3.0
13 South of Sunnyside . . . . .	2.5
20 Near Logan . . . . .	2.2
22 Rangeley, Colorado . . . . .	no mag.
30 Ephraim . . . . .	3.0
30 South of Sunnyside . . . . .	2.0
(10 rockbursts in December)	

JANUARY	Magnitude
3 Promontory Point . . . . .	1.8
6 South of Sunnyside . . . . .	2.0
6 South of Sunnyside . . . . .	2.0
6 Near Cedar City . . . . .	<1.5
8 Near Salt Lake City . . . . .	<2.0
13 Near Delta . . . . .	2.5
15 South of Sunnyside . . . . .	2.3
15 Near Salt Lake City . . . . .	1.5
21 South of Sunnyside . . . . .	2.5
22 Near Price . . . . .	3.0
22 Near Ouray . . . . .	3.5
22 South of Sunnyside . . . . .	2.5
22 Promontory Point . . . . .	2.0
25 Southwest Idaho . . . . .	3.0
26 Near Salt Lake City . . . . .	1.5
27 Near Bloom . . . . .	2.6
29 Southeast Idaho . . . . .	2.5
30 South of Sunnyside . . . . .	<2.0
31 South of Sunnyside . . . . .	2.0
(26 rockbursts in January)	

## ARE WELL LOGS GOOD LOGS?

About 150 lithologic logs of oil and gas test wells have been purchased at greatly reduced prices for the UGMS sample library collection. Obtained from a commercial logging service, most are from wells in San Juan, Kane, Garfield, Wayne, Emery and Grand counties. Use of the logs will be restricted to the sample library premises.

FEBRUARY	Magnitude
2 Southeast Nevada . . . . .	2.8
2 Near Cedar City . . . . .	2.0
3 Near Blanding . . . . .	2.6
3 Southeast Utah . . . . .	3.0
6 San Rafael Swell . . . . .	2.8
8 South of Sunnyside . . . . .	2.0
8 Southeast Nevada . . . . .	2.8
11 Near Salt Lake City . . . . .	<2.0
11 Near Cedar City . . . . .	2.0
12 Near Cedar City . . . . .	<2.0
12 Near Cedar Spring (west of Promontory) . . . . .	<2.3
16 Near Delta . . . . .	<2.0
21 Hillcreek Area (south of Ouray) . . . . .	3.6
23 Near Salt Lake City . . . . .	<2.0
25 Lund . . . . .	2.7
25 Near Salt Lake City . . . . .	2.0
28 South of Sunnyside . . . . .	2.1
28 South of Sunnyside . . . . .	2.2
(27 rockbursts in February)	

These earthquakes were recorded by the University of Utah seismograph stations under the direction of Kenneth L. Cook. All locations and magnitudes are preliminary determinations; final determinations will be printed in the University of Utah Seismological Bulletin, issued quarterly.

## USGS OPEN FILE

The U. S. Geological Survey has released in open files the following maps. Copies are available for inspection in the Geological Survey Libraries in Washington, D. C., Denver, Colo., Menlo Park, Calif., and 8102 Federal Office Bldg., Salt Lake City.

Preliminary geologic map and cross section of the Cherry Creek quadrangle and adjacent part of the Dutch Peak quadrangle, Juab County, Utah, by H. T. Morris and R. W. Kopf. 2 maps, explanation, cross section (4 sheets), scale 1:24,000.

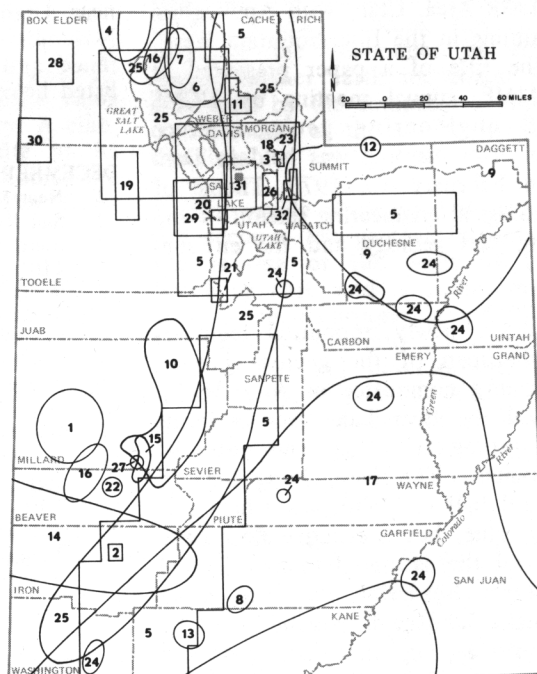
Preliminary geologic map and cross section of the Maple Peak quadrangle and adjacent part of the Sabie Mountain quadrangle, Juab County, Utah, by H. T. Morris and R. W. Kopf. 2 maps, explanation, cross section (4 sheets), scale 1:24,000.



# Summer Field Work in Utah

The geologists who plan to work in Utah during the 1970 field season are listed below. The reference numbers in the left column correspond as far as possible with the location numbers on the accompanying map.

- |   |  |  |  |
|---|--|--|--|
| 1. Armstrong, R. L.,<br>Yale University                                   | K-Ar dating of Tertiary volcanics from Millard County.   |  |  |
| 2. Averitt, P., and<br>R. L. Threet<br>USGS                               | Areal geology, Cedar City quadrangle.  |  |  |
| 3. Bailey, G. B.<br>Univ. of Iowa   | Wall rock alteration associated with Park Utah and Ontario veins.  |  |  |
| 4. Baker, C. H., Jr.<br>USGS  | Water resources of Curlew Valley, Utah-Idaho.  |  |  |
| 5. Baranzangi, M.,<br>and M. Sbar<br>Lamont-Doherty Geol.<br>Observatory  | Seismic activity along major fault zones.  |  |  |
| 6. Bjorklund, L. J.<br>USGS   | Groundwater resources of eastern Box Elder County.   |  |  |
| 7. Bolke, E. L.<br>USGS   | Hydrologic reconnaissance of Blue Spring Creek valley.   |  |  |
| 8. Bushman, J. R.<br>BYU  | Spore and pollen zonation of Wahweap Formation.  |  |  |
| 9. Clark, J.<br>Field Museum of<br>Natural History                        | Uintan and Duchesnean paleogeography of Uinta Basin.   |  |  |
| 10. Condie, K. C.<br>Washington Univ.                                     | Mapping of Cenozoic basalts in Black Rock Desert, Millard, Beaver and Juab counties.                                     |  |  |
| 11. Crittenden, M. D., Jr.<br>USGS  | Mapping of Precambrian rocks of Huntsville area.   |  |  |
| 12. Crockett, D. H.<br>U. S. Forest Service                               | Geohydrology of E. Fork of Smith Fork, north slope Uinta Mtns.   |  |  |
| 13. Goode, H. D.<br>Univ. of Utah   | Mapping of quadrangle, Skutumpah, Kane County (field geology course).  |  |  |
| 14. Grant, S. K.<br>Univ. of Missouri<br>at Rolla                         | Lab. analysis of samples of Lund tuff member, Needles Range Formation.   |  |  |
| 15. Herber, L. J.<br>Univ. of Nevada                                      | Order-disorder in coexisting plagioclase and alkali feldspar from Mineral Mtns.  |  |  |
| 16. Hood, J. W.<br>USGS   | 1. Hydrologic reconnaissance of Hansel Valley and Rozel Flat. 2. Hydrologic reconnaissance of Wah Wah Valley.            |  |  |
| 17. Johnson, A. H.<br>Univ. of Oklahoma                                   | Paleomagnetism of Jurassic rocks of south central Utah.  |  |  |
| 18. Johnson, S.<br>Univ. of Wisconsin                                     | Sulfide mineralogy of Humbug and East Flank ore bodies.  |  |  |
| 19. Maurer, R. E.<br>State Univ. of New York,<br>College at Oswego        | Geology of Cedar Mtns., Tooele County.   |  |  |
| 20. Moore, W. J.<br>USGS  | Igneous rocks of Bingham mining dist.  |  |  |
| 21. Morris, H. T.<br>USGS   | Geologic, geochemical study in East Tintic mining dist.  |  |  |
| 22. Mower, R. W.<br>USGS  | Groundwater resources of Milford area, Escalante Desert.   |  |  |
| 23. Nash, T.<br>USGS  | Fluid inclusion studies of Park City ores.   |  |  |
| 24. Ritzma, H. R.<br>Utah Geol. and<br>Mineralog. Survey                  | Oil-impregnated rock deposits  |  |  |
| 25. Smith, R. B.<br>Univ. of Utah   | 1. Microearthquake study of fault zones and induced earthquake areas. 2. Seismic and magnetic survey of Great Salt Lake. |  |  |
| 26. Smith, R. K.<br>Univ. of Iowa   | Contact metamorphism around Alta stock.  |  |  |
| 27. Strahan, R., and<br>R. Neudeck<br>Western Minerals<br>Exploration Co. | Mineral exploration at north end of Mineral Mtns.  |  |  |
| 28. Todd, V.<br>Stanford Univ.  | History of metamorphism and deformation in S. Grouse Cr.   |  |  |
| 29. Tooker, E. W.<br>USGS   | Mapping in Oquirrh Mtns. (Bingham Mining dist.).   |  |  |
| 30. Turk, L. J.<br>Stanford Univ.   | Hydrogeology of Bonneville Salt Flats.   |  |  |
| 31. Van Horn, R.<br>USGS  | Field and aerial mapping, Salt Lake City and vicinity.   |  |  |
| 32. Woodfill, R. D.<br>Purdue Univ.                                       | Mapping and petrographic analysis, Keetley volcanics.  |  |  |



## Gas Injection Begins at Bridger Lake

A miscible flood project— injection of natural gas to increase recovery of oil—will begin operating in the Bridger Lake field, Summit County, in 1970. Phillips Petroleum, operator of the field, outlined the scheme in its application to the Utah Oil and Gas Conservation Commission which approved it.

Production of oil with accompanying gas since 1966 had been characterized by a marked decline of reservoir pressures, causing concern for the ultimate maximum recovery of oil known to be present. Oil at Bridger Lake is produced flowing from an average depth of 15,600 feet from a lower Dakota Formation sandstone (Cretaceous age).

The Phillips plan is to produce the field as a closed system. Natural gas purchased from Wyoming fields from Mountain Fuel Supply will be piped to Bridger Lake and injected under pressure into a well in the center of the field. Pressures in the Dakota sandstone pay zone will be gradually increased to near the original reservoir pressure by controlling production in surrounding wells.

Gas mixing with oil and spreading outward from the central area of injection will enter surrounding producing wells and carry a foamy mixture of gas

and oil flowing to the surface. Here gas and oil will be separated and the recovered gas re-injected into the formation. Gas used to fuel the operation and some temporarily "lost" to the sandstone will be replaced by purchased gas. Years from now, as the ratio of gas to oil rises in the wells, excess gas will be sold back to Mountain Fuel.

The porous sandstone reservoir at Bridger Lake is known as an irregular body, pod-shaped in cross section, probably an ancient river channel (see accompanying diagram). Oil is trapped in the sandstone by impermeable shales above, below and around the sides. At lower structural levels in the field, the oil is floating on water which tends to press the oil upward into the trap.

The field had produced 3,429,000 barrels of oil by the end of 1969. It is expected to produce up to 40 million barrels from 12 or so wells. Recovery per well—more than 3 million barrels each—is a remarkable conservation objective to shoot for.

Newest field well, Phillips No. 8 Fork-A, SW NW 36-3N-14E, completed in January flowing 516 barrels per day, is the first located on State land. This well is expected to generate nearly \$1 million in royalties to Utah during its decades of production.

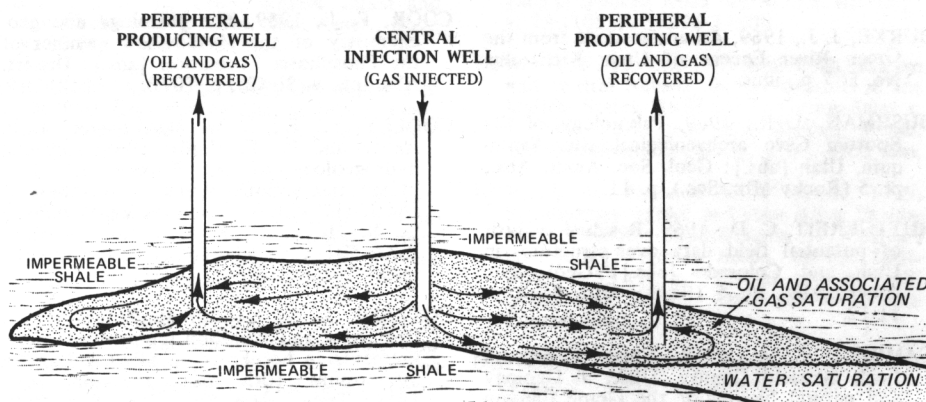


Diagram of the gas injection process.



Drilling operations at Bridger Lake Field, Summit County. (Photo courtesy Phillips Petroleum Company)

### LEGISLATIVE SESSION

Utah's first 20-day budget session of the Legislature adjourned January 31. The legislators pared \$2.5 million from Gov. Rampton's \$487.7 million budget. In keeping with their expressed resolves prior to the opening of the session, the Governor and legislative leaders avoided increases in tax rates. The lawmakers passed a "Common Day of Rest Act" requiring most retail establishments to close on Sunday unless they should elect to close on Saturday. The Governor let it become law without his signature. It includes an exemption covering "the mining and processing of natural resources."

### DOUBLETAKE

Have you looked recently at the postmark on your mail from Westinghouse? Ours reads, "The ocean's bottom is more interesting than the moon's behind."

# Utah Geology in Print

A list of papers appearing in 1969 which pertain to the geology and mineral industry in Utah has been prepared and printed below. Papers appearing in 1967 and 1968 and not included in the 1969 list have been included.

The staff of the University of Utah Engineering and Physical Sciences Library, under the direction of Edith Rich, generously provided the Quarterly Review staff with the list of papers.

The papers are listed alphabetically by author and by subject.

The following sources were used to provide information:

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## GOLD HILL BULLETIN OUT

The Gold Hill area in western Utah is the subject of the latest publication of the Utah Geological and Mineralogical Survey. Bulletin 83, *Mineralization in the Gold Hill Mining District, Tooele County, Utah*, describes one of the oldest mining sites in the state. Its history, from 1857 when travellers on the way to California through Overland Canyon stayed to look for minerals, is one of rapid mining development with a short-lived boom about 1917. Publication of geologic studies of the area started in 1892.

Sediments from Lower Cambrian through Lower Triassic comprise a relatively complete stratigraphic sequence. Tertiary pyroclastics intrude the older sediments.

Evaluation of the mineral potential shows most minerals occur in quantities too small for commercial production.

## UGMS Board Chairman Resigns

John M. Ehrhorn, Chairman of UGMS Advisory Board, is leaving Salt Lake City, and is resigning his position as chairman of the Board. He is retiring May 15 from his position of director of industrial development with U. S. Smelting, Mining and Refining Co., after 26 years with that company.

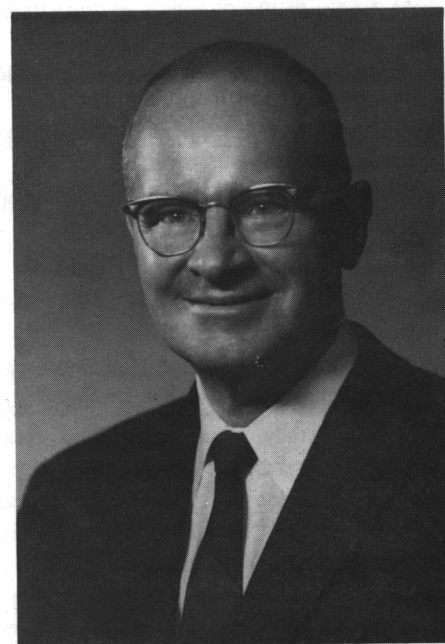
Mr. Ehrhorn plans to work at private consulting in Las Vegas.

UGMS hopes that Mr. Ehrhorn will be able to continue to be a member of its Advisory Board. His steady interest and constructive guidance during his term as chairman has been immensely valuable, and he will be missed.

The area, however, does contain impressive quantities of tungsten and low-grade beryllium ores, and large quantities of arsenic were produced during World War II.

Bulletin 83, by H. M. El-Shatoury and J. A. Whelan, arises from a doctoral dissertation by E. Shatoury. Whelan, staff member of UGMS, supervised the research and assisted in preparation of the manuscript for publication.

Bulletin 83 is for sale at the Utah Geological and Mineralogical Survey, 103 Utah Geological Survey Bldg., University of Utah, Salt Lake City 84112, for \$2.25. Maps of the area, plans of most of the Gold Hill mine workings and analyses of ore samples are published in this bulletin.



John M. Ehrhorn

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